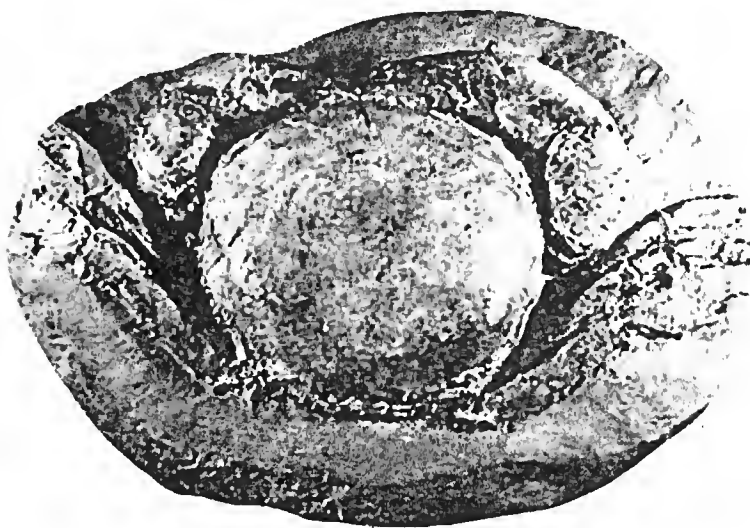
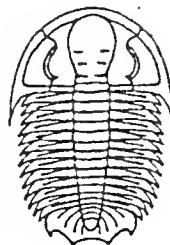


THE FOSSIL COLLECTOR

BULLETIN No. 74

JANUARY 2005



Late Miocene crab *Tumidocarcinus giganteus* Glaessner, 1960.

Published by
THE FOSSIL COLLECTORS' ASSOCIATION OF AUSTRALASIA
ISSN 1037-2997

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Taxonomic Disclaimer

This publication is not deemed to be valid for taxonomic purposes [see article 8b in the *International Code of Zoological Nomenclature* 3rd edition 1985. Eds W. D. Ride et al].

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EDITORIAL NOTES.

I hope everyone had a wonderful, safe time over the Christmas/New Year period and that the time spent with family and friends was special.

This is somewhat of a landmark year for my involvement with *The Fossil Collector*. Bulletin 45 (May 1995) was the first issue that had my name under the Editor heading, all I can say is where have the past ten years gone. What have I gained over the past ten years about editing *The Fossil Collector*? Some would argue (including myself), not a whole lot and it is probably just as well I have some very able and tolerant proof readers who keep me on the straight and narrow, and correct all my errors. My intention is to do the job for another ten years, at least, as it is something I greatly enjoy. Of course, I can only continue doing the editor's job while there is material to put into each issue and I would ask that readers consider writing something for *The Fossil Collector* so that the F.C.A.A can continue to publish what is a respected and highly regarded publication.

This year will also see my return to the rock face after the car crash in 2003 and I can hardly wait for the weather to cool down so I can get back out there. When I take into account all the odds that were stacked against me at the time of the crash, I can't let the fact that I still have my leg attached to my body pass me by, and while it may be somewhat shorter than its neighbour, this can be easily compensated for.

In this issue I have written a small story on fake fossils. This was bought about when I purchased a beautiful shrimp specimen which turned out to be a very good fake. The practice of selling reproduced fossil specimens as the real thing is widespread and includes numerous different types of fossils. It is something that has been with us for a long time (the most famous example being that of Piltdown Man) and will continue to be a problem while there is money to be made. I do not hold the dealer I bought the shrimp specimen from to blame for the fake as he was duped probably more so than I. It was only through a lot of experience that even I was able to determine the shrimp was probably a fake, then verification of this was made by a professional institution quite quickly, the joys of having higher magnification on hand. Amber could be considered the most dominant faked fossil, a story on amber appeared in *The Fossil Collector*, Bulletin 60, p9.

BOOKS AND BOOK REVIEWS

THE GEOLOGY OF AUSTRALIA by David Johnson (*James Cook University, North Queensland*). Published by Cambridge University Press Australia, 2004. Hardback edition, 288 pp. ISBN 0-521-84121-6. Australian price \$150.00.

Geologist David Johnson tells the fascinating story of how our unique island continent was created and evolved. *The Geology of Australia* guides us effortlessly through 4400 million years of history with extensive use of colour plates and easy to follow diagrams – from the buildup of mineral resources that brought us so much of our modern wealth, the creation of the Barrier Reef and the development of our famed coastline, to the grandeur of Uluru. Much more than a simple text, Johnson draws many fascinating stories out of our country's landscape, showing what our own land tells us, amongst other things, the break-up of Gondwanaland, the geology of the Solar System, and even the origins of life on Earth.

This is a book for anyone who has ever wanted to know more about the timeless forces that shape the land around us. From Uluru to the Great Dividing Range, from sapphires to stromatolites, *The Geology of Australia* is a comprehensive exploration of the timeless forces that have shaped this continent and that continue to do so.

Chapters: 1. An Australian perspective; 2. The Earth - a geology primer; 3. Building the core of Precambrian rocks; 4. Warm times - tropical corals and arid lands; 5. Icehouse - Carboniferous and Permian glaciation; 6. Mesozoic warming - inland plains of the Triassic and Jurassic; 7. Birth of modern Australia - flowering plants, mammals and deserts; 8. Eastern highlands and volcanoes barely extinct; 9. Building the continental shelf and coastlines; 10. Great Barrier Reef; 11. Planets, moons, meteorites and impact craters; 12. Cycles in a continental journey.

Information from Cambridge University Press Australia

Kia Ora, New Zealand (Welcome, New Zealand)

Chris AhYee & Janice Krause

During mid to late September, 2004, we travelled to the South Island of New Zealand with the opportunity to visit the New Zealand National Gem, Mineral and Fossil Show held at Blenheim, and a week later, the Canterbury Gem, Mineral and Fossil Club Show held in Christchurch. Also, with the assistance of local Lapidary Club members, we visited several fossil localities where we had the opportunity to collect.

The National Gem, Mineral and Fossil Show at Blenheim

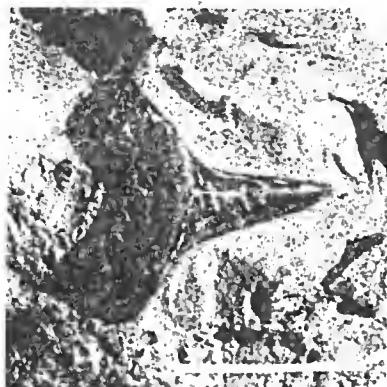
This Annual Show is held alternately in the South Island and the North Island and represents the largest of the New Zealand Shows. Fossil competitions are held in three classes, namely – New Zealand, Overseas, or a combination of both. There is also a trophy for the best Ammonite in either the display or competition sections.

One showcase was devoted to fossils from the Oaro coastal area located on the eastern coast just south of the main town of Kaikora. This is a Cretaceous marine locality and was one of two field trips organised by the National Show Committee. Other interesting New Zealand fossils noted were the well-preserved Jurassic plants from Cape Huriwai, Waikato Heads in the North Island. These were mainly represented by *Cladophlebis australis* and *Taeniopteris* sp., two genera also found in Australia.

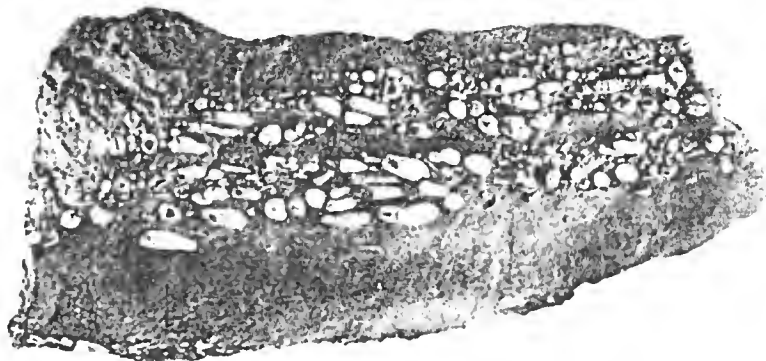
Oaro Field Trip

As mentioned, this is a Cretaceous locality and represents the type locality for the Mate Series (Haunurian and Pirpauan). Walking south along the sandy beach from the Oaro Settlement towards Amuri or Haumuri Bluff, close examination of the first boulder-strewn area reveals water-worn boulders containing belemnites, sharks' teeth, reptile teeth and occasional vertebrate

bones of marine reptiles such as Plesiosaur and Mosasaur. Good specimens of belemnites can be obtained by finding a nodule that shows a layer of belemnites on the surface, and then, by carefully 'cracking' around this layer with a geological hammer, positive/negative halves are obtained containing not only belemnites but also sharks teeth and the odd bone fragment. To try and chip the sharks' teeth out is not recommended, as they often 'splinter' off due to the brittle nature of the matrix.



Late Cretaceous sharks' teeth from weathered boulders on beach at Amuri Bluff, south of Oaro, east coast of South Island, New Zealand. Scale bars 1 cm.



Naturally weathered specimen of Late Cretaceous belemnites from coastal outcrops, east coast of the South Island, New Zealand. Photograph, courtesy Graham Stevens. Slab 44 cm long.

Canterbury Mineral and Lapidary Club Show, Christchurch

This was by far a much smaller show yet some very interesting fossil specimens were on display, in particular the crabs found in concretions along the North Canterbury Motunau Beach and from the Dovedale Stream localities. Also on display was a large concretion containing a 25 cm long specimen of the crayfish *Metanephrops motunauensis*. Both of these localities lay some 80 kilometres northeast of Christchurch. The cliffs each side of Dovedale Stream contain concretionary boulders that are derived from the Upper Miocene Greta Siltstone of the Taranaki Series. Weathered concretions litter the beach where high tides and storms sweep the concretions up and down the coast.

The most notable fossils are the well-preserved crabs, *Tumidocarcinus giganteus*, and the spiny crab *Trichopeltarion greggi*, but other concretions yield shells, whalebone and occasionally sharks' teeth. An excellent display of these crabs can be seen in the Geology Section of the Canterbury Museum, Christchurch.

The Vanished World Fossil Trail, North Otago

This was a chance finding, as we had originally planned to search around the lower Waitaki River valley located inland between Timaru and Oamaru. In this area outcrops of the Landon and Arnold Series limestones contain many fossil molluscs, brachiopods, echinoids and rare whale and dolphin remains.

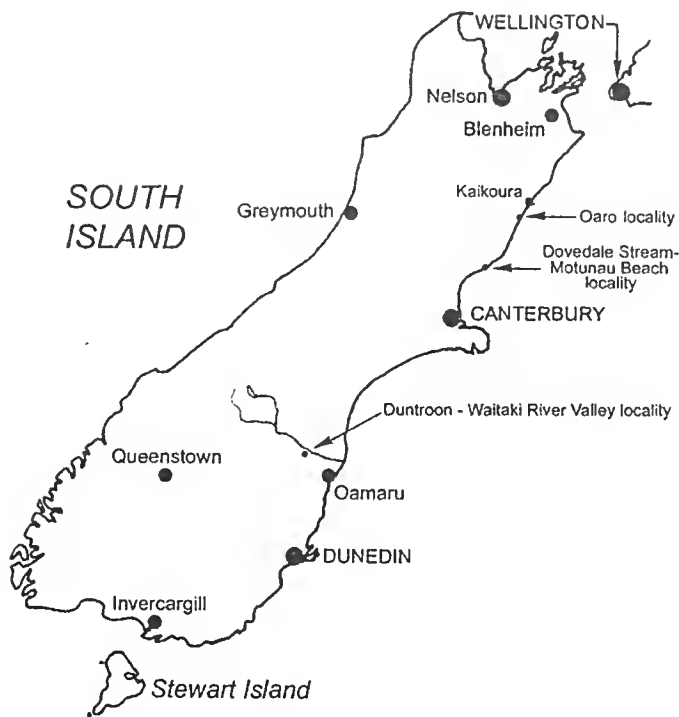
The Vanished World Centre is located in the small inland town of Duntroon and houses a wealth of unique local fossils. For a small fee the Centre sells a colour brochure and map of the Vanished World Trail that details the ancient geological and palaeontology history of North Otago, with fossil sites, ancient volcanics and volcanoes, mineral localities and major landforms. All sites are accessible by road and have signposts or other onsite explanations.

We were fortunate to be shown round this area by Jeff Fathers from Oamuru (a F.C.A.A.Member) who took us to an area where the large echinoids *Pericormus crawfordi* and the endemic New Zealand echinoid *Taimanawa greyi* are known to occur. Another particular locality of interest was 'Earthquakes' where large blocks of the Otekaike Limestone tumbled down when the land slumped many years ago. Many fossils were visible in the limestone and the underlying Kokoanu Greensand. Again the large Spatangoid echinoids *Pericormus*, *Taimanawa* and *Lambertona* were present as well as the 2 mm specimens of the small echinoid *Fibularia*. Also found here is the impressive bivalve *Lentipecten hochstetteri*, measuring up to 10 cm long, and numerous brachiopods of the species *Waiparia elliptica*.



Aboral view,
Pericormus crawfordi
(Hutton, 1873).
Locality unknown.
Age range of species,
Early Oligocene to
early Middle Miocene.
Specimen 12 cm
wide. Photograph,
courtesy New
Zealand Geological
Survey.

Besides the display at Duntroon, excellent displays of Otago and South Canterbury fossils are to be found at the Otago Museum in Dunedin. Many of these fossil localities are easily accessible and access onto farms is often freely given, except during the lambing season !!!!!!!



Locality map. South Island, New Zealand.

Further information, reading and contacts:

The Reed Field Guide to New Zealand Geology by Jocelyn Thornton. Reed Publishing (NZ) Ltd [New edition published 2003].

Illustrations of New Zealand Fossils, compiled by I. G. Speden and I.W.Keyes. A New Zealand Geological Survey Handbook. Wellington, 1981.

The Geological History of New Zealand and its Life by C. A. Fleming. Auckland University Press, 1979.

Vanished World Centre, 7 Campbell Street, Duntroon, North Otago, New Zealand. Web site: www.vanishedworld.co.nz

Department of Geology, University of Otago.

Web site: www.otago.ac.nz/geology/featurespaleontology/kokoamu.html

Messrs Jeff & Heather Fathers, 18 Clyde Street, Oamaru, New Zealand. Telephone (03) 434-8176.

ARE YOUR FOSSILS FAKE

Paul Tierney

Ever wondered if that exquisite fossil you purchased from the internet or site unseen from a dealer, and has just arrived in the mail, is all it is cracked up to be. I did when an absolutely beautiful shrimp specimen arrived for me in the mail, labeled as a specimen of *Tharsophlebia* from Solnhofen, Germany (Fig. 1).

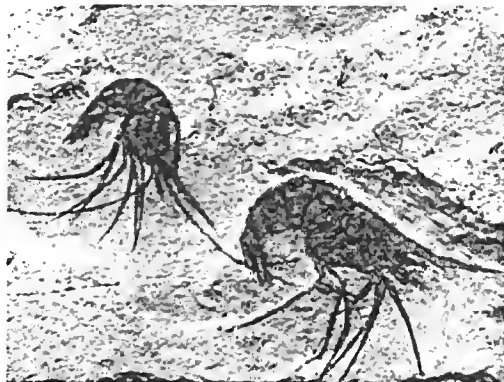
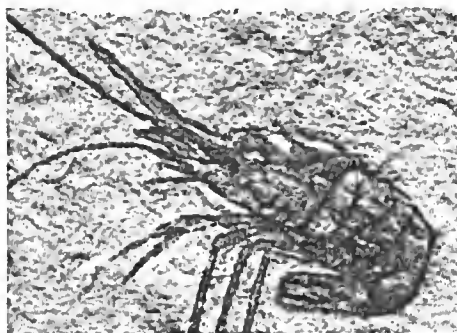


Figure 1. The shrimp specimen from ?Solnhofen.

What immediately through me was the rock, it just didn't look like other examples of Solnhofen limestone I had seen and touched, and the specimens looked far too perfect. A search of the internet and relevant volume of *The Treatise of Invertebrate Paleontology* failed to produce any reference to a shrimp called *Tharsophlebia*. A further, more detailed search did produce a positive identification of the shrimp specimens in question, they turned out to be *Carpopenaeus longirostris* from the Cretaceous of Lebanon.

Figure 2. *Carpopenaeus longirostris* from the Cretaceous of Lebanon. They are quite popular and were sold at relatively high prices for some time due to their beautifully preserved detail. The detail of the real shrimp is not good at all with all the detail being painted on, some artists are better than others.



My next problem was the detail in the specimens, they were just too perfect and as my curiosity had now been raised by the incorrect identification and locality, the fossils were inspected under magnification where it became obvious that all the detail had in fact been painted on both the rock and over very incomplete shrimp specimens.

The act of creating fake fossils or enhancing otherwise inferior fossil specimens is widespread and is something which has been happening for longer then we would all dare to think. Probably the most famous, or infamous, fake fossil is that of Piltdown Man and of course, more recently, we have a bird from China which was actually a composite of two different types of animals.

Many readers will already know the Piltdown saga but for those who don't, I will provide a brief outline of the story. In 1908 several hominid like fossils were found in a gravel pit in Sussex, England that were reported to be Great Britain's oldest human form, a supposed 'missing link' named *Eoanthropus dawsoni*, or Piltdown Man, British scientists at the time believed the fossils could quite possibly date from the Late Pliocene. As we now know, Piltdown Man was a fraud, consisting of a human skull and the jaw of an ape. It wasn't until 1953 that British scientists were able to unravel the facts behind the forgery using methods that were unavailable forty years before. It is unfortunate to note that until 1953 around 500 doctoral dissertations were published on the evolutionary significance of Piltdown Man. Several noted people have been linked to the forgery, the most famous of which is Sir Arthur Conan Doyle, the creator of Sherlock Holmes.

As for the Chinese ?bird, it had everyone fooled, ranging from respected and highly qualified palaeontologists, highly respected publications and the public in general. This forgery is just one example of how sophisticated the art of fossil fakes or forgeries has become.

For us amateur collectors it can be somewhat of a minefield when

it comes to knowing what fossils are fake and what are real. Unfortunately, experience, a keen eye and being caught a few times are the only teachers. What fossils can be faked, forged or doctored? In real terms almost anything. Most notable on today's market are Moroccan trilobites, Lebanese shrimps, amber, all sorts of fossils from China, even the humble and plentiful Green River fish are not sacred. Following are some examples of fake fossils which I will include for the benefit of all, as information on them is very hard to come by.

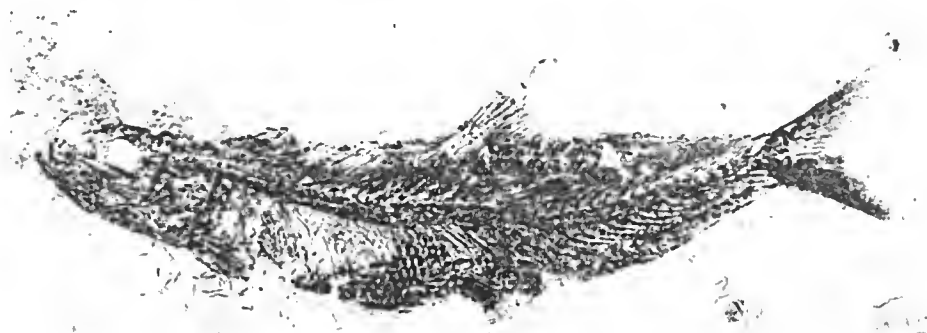


Figure 3. A composite of the Green River fish *Mioplosus* (front half) and *Diplomystus* (rear half), Note the join just in front of the dorsal fin and passing from left to right through the specimen.

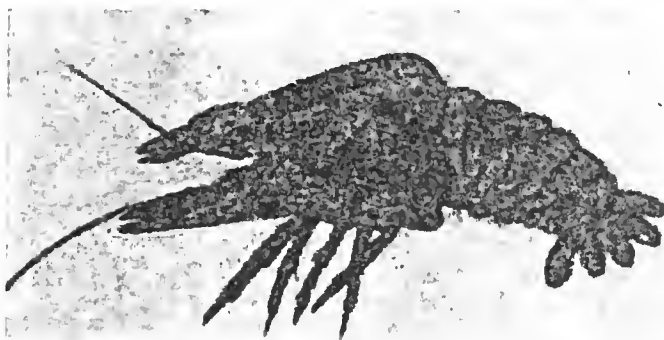


Figure 4. *Astacus spinorostrinus* are from the famous fossil site in Liaoning, China. Like the Lebanese shrimp they are painted over incomplete specimens, are not as good as the shrimp from Solnhofen and the real one doesn't look so strange.



Figure 5. A fossil bird from China. The rock is natural while the skeleton is artificial material glued to the rock then sand applied to the contact area to cover the gap, however, the glue mark is still clearly visible.



Figure 6. *Bothriolepis canadensis*, a primitive Devonian fish. This is cast resin with the fish painted black. It is easily distinguished by its light weight and warm feeling when touched.



Figure 7. The skeleton of this *Keichousaurus* was carved from the rock, the coloured black. The first clue is there are no preparation marks around the fossil as one would expect if it were natural. When examined through a 10X lens, the skeleton lacks detail, especially in the skull area. Carving marks are also clearly visible.

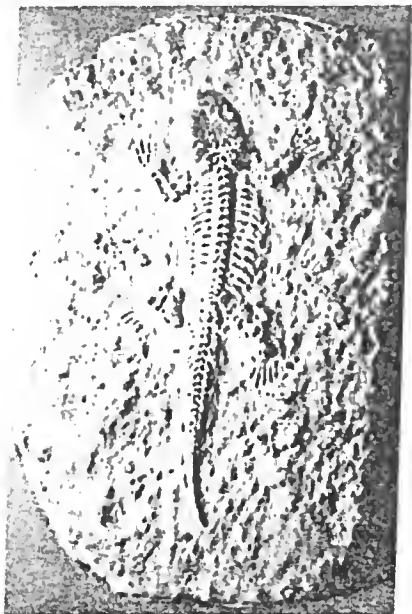
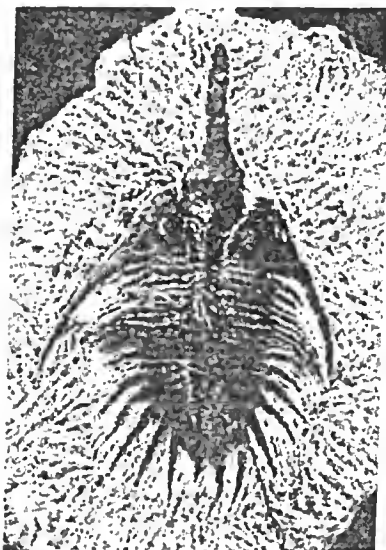
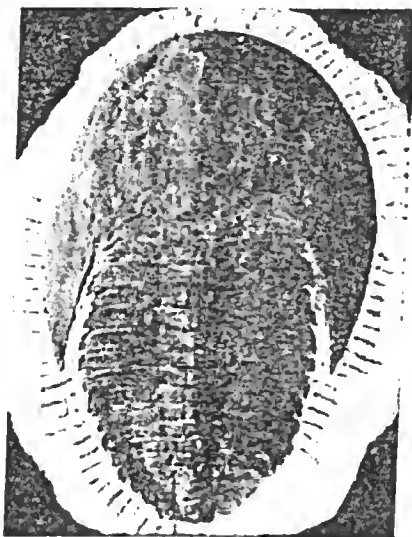


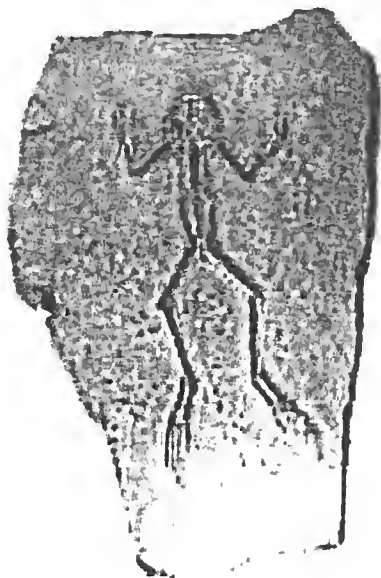
Figure 8. A reptile fossil from China. The whole piece is a cast of mixed resin and powdered natural resin, the fossil is then coloured brown and the surface is dusted with some kind of fine powder to give the 'rock' a weathered look.



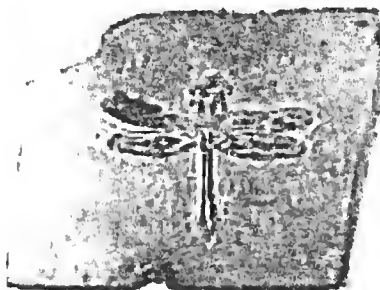
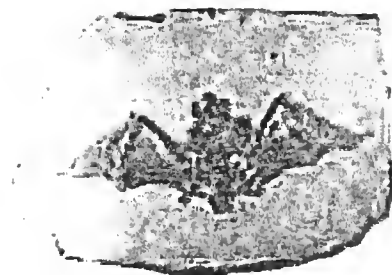
Figure 9. A layer of gypsum is applied to a natural rock then the scorpion is painted on. This fake is fairly evident as the gypsum gives it away, also the scorpion lacks the detail a real fossil would have.



Figures 10 & 11. Moroccan trilobites. These are cast from a mix of resin and powdered rock, then coloured and the preparation marks added. The giveaway at major fossil shows is that they all look the same, a sign of mass production.



Figures 12 to 16. Various fossils from China. All are cast from a mix of resin and powdered rock, then the 'fossil' is coloured black. These, especially the frog, butterfly and dragonfly are popular auction items on Ebay and other internet auction sites.





Figures 17 & 18. More Chinese cast resin and powdered rock fossils popular on internet auction sites.

In my opinion there is a place for these created or touched up fossils as the better ones can be considered works of art and if the reproduction is faithful then it could be of a fossil specimen that is rare and hard to find. My argument is that they should be sold as reproductions or touched up originals and not as the real thing, this of course deflates the value and in a world where money talks, it makes my argument a little mute. In saying that, if potential customers knew they were buying a reproduction of a rare fossil, they might be prepared to pay a lower price for the copy?

How does one tell if the Moroccan trilobite or Chinese fossil is a resin fake? Quite easy really, but I believe most sellers would be a little tense if a person approached them with a gas torch, pliers and nail, then proceeded to stick said, now red hot nail into their fossil specimens to see if they start to smoke. Real rock does not smoke but a resin mix will. As for painted specimens, if it looks too good to be real then it is probably not the real thing, some form of magnification will help here.

References and further reading

- Debus, Allen. A., 2004. *Skullduggery: A Piltdown Elementary (Pt.1)*. Fossil News - Journal of Avocational Paleontology. Volume 10, Number 3. March 2004
- Walsh, John. E., 1996. *Unraveling Piltdown: The Science Fraud of the Century and its Solution*. Random House.

BOOKS AND BOOK REVIEWS cont

EVOLUTION OF FOSSIL ECOSYSTEMS by Paul Selden and John Nudds. Manson Publishing Ltd, London, 2004. Softcover edition ISBN 1-84076-041-9. U.K. price for softcover edition £19.95, Australian price \$72.00 (CSIRO Publishing), both plus packing & postage.

Major advances in our understanding of the history of life on earth have resulted from the study of exceptionally well-preserved fossil sites (Lagerstätten). Study of such sites from around the world and from different periods in geological time can provide a fairly complete picture of the evolution of ecosystems down the ages.

With this aim in mind, the authors have brought together succinct summaries of 14 of the better-known fossil Lagerstätten. Beautifully illustrated throughout by over 250 colour photographs, black & white reconstructions, locality maps and diagrams showing stratigraphy.

Following a general introduction to fossil Lagerstätten, each chapter deals with a single fossil site and follows the same format in detailing its evolutionary position and significance; its background sedimentology, stratigraphy and palaeoenvironment; a description of the biota and palaeoecology; and a comparison with other similar Lagerstätten. Each chapter has its own list of references (further reading) and at the end of the book there are appendices listing relevant museums and site information.

Lagerstätten described and illustrated in the 14 chapters are:-

- | | | |
|--------------------|-----------------------------|----------------------|
| 1. Ediacara | South Australia | Precambrian |
| 2. Burgess Shale | British Colombia,
Canada | Middle Cambrian |
| 3. Soon Shale | South Africa | Upper Ordovician |
| 4. Hunsrück Slate | Germany | Lower Devonian |
| 5. Rhyne Chert | Scotland | Lower Devonian |
| 6. Mazon Creek | Illinois, U.S.A. | Middle Pennsylvanian |
| 7. Grès à Voltzia | France | Lower Triassic |
| 8. Holzmaden Shale | Germany | Lower Jurassic |

9. Morrison Formation	Utah, Wyoming & Colorado, U.S.A.	Upper Jurassic
10. Solnhofen Lst.	Germany	Upper Jurassic
11. Santana & Crato Fms	Brazil	Lower Cretaceous
12. Grube Messel	Germany	Lower Eocene
13. Baltic Amber	Baltic Sea	Middle Eocene- Lower Oligocene
14. Rancho La Brea	Los Angeles, U.S.A	Quaternary

This book is a mine of up to date information on fossil ecosystems and while it will be of considerable value to a wide range of students and professionals in palaeontology and related sciences, it is equally as relevant to amateur enthusiasts.

Information: www.manson-publishing.co.uk/science/sci_titles/SeldenNudds

IN THE NEWS

Fossil Find Suggests Dinosaurs Were Doting Parents

A newly announced dinosaur discovery in China suggests that the creatures put in some quality parenting time. Last year researchers unearthed the fossil remains of an adult *Psittacosaurus*, a plant-eating, parrot like dinosaur that grew to be a metre tall. The adult was surrounded by 34 juveniles, a close association that indicates that the dinosaur continued to care for its young even after they hatched. The discovery suggests the care that crocodiles, birds, and other modern descendents of archosaurs give to their young may be an ancestral characteristic (Archosaurs are a subclass of reptiles that includes dinosaurs, pterosaurs, and crocodilians).

The *Psittacosaurus* fossils, which are 125 million years old, were found by farmers in the northeast Chinese province of Liaoning, and are now housed in the province's Dalian Natural History Museum. *Psittacosaurus*, also known as a "parrot lizard" for its parrot like beak, was a herbivore and was a strong, agile dinosaur that walked on its two hind legs, it ate mostly tough stems and fruit. The specimens are in excellent condition with no

separated bones or partial skeletons, which suggests that the dinosaurs were rapidly entombed while still alive. Researchers speculate the dinosaurs may have been buried by volcanic debris, trapped in a collapsed burrow, or flooded in their nest.

The close proximity of the *Psittacosaurus* fossils - the adult and juvenile skeletons were all located within half a square metre - points to a biological relationship and post-hatching parental care. The hatchling size of the *Psittacosaurus* is not known but the juvenile bones found were well formed and fully hardened, or ossified, the youngsters' apparently healthy state suggests the adult had cared for its offspring.

Recognizing parental care in the fossil record has been difficult in the past, because behavior isn't typically discernable from a single time-slice, this specimen is a rare snapshot of a moment - the last moment - in these dinosaurs' lives and shows them clustering around an adult. Past studies have suggested that other dinosaur species displayed parental care by, for example, feeding their young but researchers were not sure if such behavior extended to all dinosaurs. This discovery suggests maybe all dinosaurs extended some form of parental care to their young.

Crocodiles and birds assist their young by hatching them, feeding them, providing warmth and shelter, and protecting them from predators. If these modern animals inherited such parental skills from their predecessors, the dinosaurs, it may help explain why dinosaur descendants have been so successful. The discovery also adds to the ever-increasing picture of dinosaurs as being more sophisticated and more complex animals than was imagined 50 years ago, when they were thought of as sluggish, cold reptiles.

Summary of story from *National Geographic News*, September 8, 2004.

Fossils Show Climate Influencing Evolution: Changes Affect Genetic Course of 2 Rodents

For nearly 20 years, Elizabeth Hadly, a Stanford biologist, has

been digging up the fossils of wolves, elk and tiny rodents deeply buried for more than 3,000 years in a remote cave hidden in the corner of Yellowstone National Park. Now she has found for the first time that changes in the Earth's climate - particularly global warming - can influence genetic changes that alter the pace and direction of animal evolution.

Rather than conducting her experiments on genetic diversity with generations of fruit flies or bacteria in the climate-controlled environment of her own laboratory on the Stanford campus, Hadly and her team of graduate students and postdoctoral scholars have gone to the natural world to collect their data. Her research subjects are the montane voles and northern pocket gophers of the Rockies - specifically the fossil rodents of Yellowstone's Lamar Cave, which lies beneath the northeastern ranges of the park, in a secluded area protected for its archaeological importance.

Back at the laboratory, the rodents' fossil remains, covering the past 1,150 years, yielded DNA to compare with the genes of modern-day wild rodents living nearby - a comparison that vividly documented the genetic changes. The cave has been populated by the furry rodents for at least 3,000 years, with the populations of the voles and gophers ebbing and booming during major periods of past climate warming and cooling.

For the past seven years, Hadly and her research team have rooted around in the dirt-covered layers of the cave's animal remains. Digging their way down more than 8 metres, they have excavated and identified hundreds of thousands of bones, including those of the two animals whose genes they want to study: the voles (*Microtus montanus*) and the gophers (*Thomomys talpoides*).

One of the fundamental discoveries made by Hadly and her team is that the populations of both rodent species declined significantly during the epoch of global warming known to climate

historians as the Medieval Warm Period, which lasted roughly from 850 to 1350. During that period, temperature averages were higher while the animals' habitats became drier than in earlier years. Fossil evidence of the voles from that period showed they experienced a population decline of 40 percent during the warm epoch, while the fossil gophers showed a decline of 50 percent because of the hostile climate. Similarly, both rodent species experienced dramatic population upsurges throughout a more recent relatively cold and wet period known to scientists as the Little Ice Age, which lasted from about 1350 until about 1900, when the current era of global warming began accelerating.

But there is much more to Hadly's research than mere evidence of changes in rodent population size due to climate change. Her team has discovered clear evidence of climate-induced changes in the rodents' genetic diversity, based on the group's analysis of DNA in about 10,600 specimens of teeth from the fossils that had lived during the two earlier periods of climate change. The scientists compared the genetic material of those fossils with DNA from the voles and gophers that now live abundantly in the area around Lamar Cave, and found significant differences in the degree of gene diversity between the two species of animals.

Earlier studies have shown that when an isolated population shrinks, the animals increase their inbreeding with each other; as a result, their surviving offspring tend to end up inheriting DNA that is unchanged and similar between individuals, in other words, their genetic diversity diminishes, and evolutionary change becomes less likely. The entire inbred population is then jeopardized as each individual has inherited the same vulnerability to diseases as their parents. That's exactly what Hadly predicted would happen to the DNA in the fossil pocket gophers from the Medieval Warm Period she studied - and exactly what she and her colleagues found when they analyzed their genes. Because the gophers live underground, isolated in close groups and rarely venture widely, they inbred more often as their populations shrank, their genetic diversity decreased significantly and their

DNA remained relatively unchanged.

The opposite, however, was true for the montane voles. Those animals move widely beyond their cave, scurrying around the entire region and routinely seeking their mates from more widely dispersed colonies. Even though their numbers decreased during the Medieval Warm Period, the fact that they mated with voles from distant groups beyond their cave endowed their offspring with varied genes, increased the diversity of the genetic inheritance they could pass on to their descendants.

Hadly's research in Lamar Cave began in 1985, when she was a graduate student at Northern Arizona University in Flagstaff studying ecological changes on Earth over the past 2 million years. Scientists at the time were debating whether or not Yellowstone's elk and wolves were native to the park or recent arrivals from elsewhere in the West. Searching for evidence in northeastern Yellowstone's Lamar River valley, Hadly discovered the cave and found it filled with fossilized animal remains. The cave also held the remains of small animals like squirrels, packrats and mice, and larger ones including bison, antelope, bighorn sheep, grizzly bears, coyotes and beavers. But the wolf evidence proved crucial when radiocarbon dating established that the cave's remains were at least 3,200 years old.

Summary of story from the *San Francisco Chronicle*, September 20, 2004.

"Sleeping Dragon" Fossil May Link Dinosaurs, Birds

Paleontologists have discovered a duck-size dinosaur they believe died while catching some z's. Researchers found the creature's fossilized remains curled up with its head tucked under a forelimb, a pose that today is unique to sleeping and resting birds. Mark Norell, chairman of the division of paleontology at the American Museum of Natural History in New York, said the discovery further strengthens the chain linking dinosaurs and birds, suggesting this birdlike sleeping posture first evolved in dinosaurs. The new dinosaur, named *Mei long*, which is Chinese for "soundly sleeping dragon," is 53

centimetres long and is believed to demonstrate stereotypical bird behavior in another nonavian theropod dinosaur. *Mei long* is a troodontid, one of the most birdlike types of theropods with several other features of *Mei long* supporting theories that nonavian dinosaurs were warm-blooded and that small size was a prerequisite for flight.

Researchers discovered *Mei long* in Liaoning Province in northeastern China, the region is fast becoming known as a treasure trove for dinosaur finds and is yielding fossils that provide unprecedented details about dinosaur behavior and body covering. Several dinosaur fossils from the region include evidence that they were covered in hairlike feathers, including an early cousin of *Tyrannosaurus rex* named *Dilong paradoxus*.

While feathered dinosaur discoveries are becoming almost routine, the discovery of a sleeping dinosaur is a rare surprise. The new fossil specimen is an almost fully-grown adult; it sits on long, folded hind limbs, its forelimbs are folded birdlike next to its body and its neck curves to the left, so that its relatively small head lies between the left elbow and body, the posture is identical to the "tuck-in" posture of many living birds.

Mei long was found in layers of volcanic and riverbed sediment that have been dated to about 130 million years ago, at that time, Liaoning Province was a volcanically active, forested region filled with lakes and streams. It is difficult to imagine how a fossil can be preserved in such a posture and researchers think one possible scenario is that exposure to a volcanic gas killed the creature during its sleep and subsequent flows of mud and ash buried it, another theory is that the dinosaur was in a cave or burrow and covered instantly in a thick ash fall.

Living four-legged creatures rest and sleep in various postures, but only birds and a subset of mammals rest on folded limbs, and only birds, with their long, flexible necks, tuck their heads behind a forelimb or wing to rest. Scientists think birds curl up in this manner to conserve heat; tucking their heads under a feathered

wing keeps them warm.

Distinguishing it from most previously discovered troodontids, *Mei long* has large nostrils, a relatively small skull, long hind limbs, numerous closely packed teeth in the middle of its jawbone, and a large, U-shaped wishbone. The fossil shares many features with dromaeosaurs (small, meat-eating dinosaurs with large heads, sharp teeth, and clawed hands) and avialans, the group that includes living birds. Examples of these features include a short snout, a long forehead, a large eye socket, a long and thin forearm, an L-shaped bone at the shoulder joint, and a shoulder blade close to the spine, among others.

Summary of story from *National Geographic News*, October 13, 2004.

Ancient Clams Lived 120 Years

Researchers have found fossil clams from Antarctica that lived for more than 120 years and defy conventional wisdom about longevity in nature. Cold climates, coupled with short growing seasons, are usually called on to explain how some creatures live for decades or centuries. But the Antarctic waters where the clam *Cucullaea raea* lived some 45 million years ago weren't any colder than those off North Carolina, said Syracuse University geologist Linda Ivany.

When the clams were first examined it wasn't thought the growth bands on the shells could be annual but one of Ivany's then undergraduate students, Devin Buick (now at the University of Cincinnati), expressed an interest in checking it out to be sure. Using a specially mounted dental drill and camera to extract samples precisely from light and dark-colored individual growth bands; Buick and Ivany were able to measure oxygen and carbon isotopes changes as the clam grew. What the isotopes revealed were regular cycles of warming and cooling - seasons. That means not only are the bands indeed annual, like tree rings, said Ivany, but they also reveal that the clams stopped growing every year at an unlikely time: in summer.

What she expected was for the clams to slow down and stop growing in winter, when the water was colder, sunlight dimmer and food scarcer. Ivany speculated that the clams might have diverted their energy from growing shells and into reproduction in the summer.

As for why the clams attained such an old age, it turns out that cold is also not a factor for some long-lived modern mollusks, said biologist Teresa Newton of the U.S. Geological Survey. Newton has worked on long-lived mussels, clams and other mollusks in such temperate places as the lower Mississippi River and Ireland. Newton is not convinced the clam's longevity is cold related, as one of the evolutionary advantages of a long life is something as simple as reproductive length. In other words, nature might have favoured long-lived clams because they had a better chance of reproducing and continuing the species if they lived to see many mating seasons, call it evolution's "Try, try again" strategy. Another longevity possibility for the Antarctic clams is that they starved a lot of the time, said Ivany. Caloric restriction has been found to extend the lives of many animals, and Ivany isn't ruling it out.

Summary of story from *Discovery News*, October 14, 2004.

Earliest Unhatched-Bird Fossil Found

Paleontologists in China have unearthed a 121-million-year-old fossil bird embryo that is likely the world's oldest. The bird was found scrunched in an oval-shaped space slightly smaller than a chicken egg - one of several clues that suggest the bird never hatched. More important, scientists say, is the evidence that the embryonic bird had feathers, a large skull, and hardened bones, these findings support the notion that early birds, like dinosaurs, were well developed at birth and able to move and forage on their own from the very start. The same theory suggests that birds that give birth to helpless, naked young evolved much later. Paleontologists Zhou Zhonghe and Zhang Fucheng, researchers from the Institute of Vertebrate Paleo-anthropology at Beijing's Chinese Academy of Sciences discovered the fossil in Liaoning Province in northeastern China.

The bird is preserved in a space that measures approximately 35 by 20 millimeters, which is bigger than a robin's egg, no eggshell was preserved. It was first thought that the fossil may not have been in an egg, however, several lines of evidence appear to exclude this. The

fossil's egg like shape provides one bit of evidence, another is that the fossilized bird rests in a "tucked" posture that is consistent with a late-stage embryo rather than a hatchling, the researchers said. They also note that the bird's feathers did not differentiate into barbs (the side structures of a feather that branch from the shaft), which is typical of a late embryo and not a hatchling. It is still a mystery why no eggshell was preserved.

Zhou believes the bird is an enantiornithine, the most common bird type found during the early Cretaceous period in China. Several other enantiornithine species are known from the deposit where the latest fossil was found, but it is difficult to link the embryo to a specific genus or species. Other researchers, however, are less certain of the identification, noting that half of the fossil's characteristics are not exclusive to enantiornithines. They add that characteristics that would identify the fossil an enantiornithine are "either dubious or not well preserved on the specimen."

According to Zhou and Zhang, the bird embryo had a large skull, feathers, and a hardened skeleton, these features signal that the bird was precocial, or mature enough to move and feed independently upon hatching. Finding such an ancient, well-developed, unhatched bird supports the idea that Earth's first birds were also precocial when young. Bird species with helpless, naked young, known as altricial, evolved later, according to the paleontologists. Zhou and Zhang also suggest that the fact that early birds had well-developed young suggests it was a trait derived from dinosaur ancestors - that this species may have evolved from dinosaurs. For example, research suggests that *Troodon*, a fast moving, meat-eating theropod dinosaur from the Cretaceous, developed precocially.

Some modern bird embryos have a special structure on the top of their bills known as an egg tooth, which they use to break open their eggs while they hatch, this egg tooth drops off soon afterward. The unhatched bird in the newly discovered fossil lacks an egg tooth, which suggests the feature, evolved later, according to the paleontologists. Instead of an egg tooth, the bird has long, curved nails, which it probably used to break open the shell, the claws also suggest the bird was adapted to living in trees.

A hundred and twenty-one million years ago, Liaoning Province in northern China was a forested landscape dominated by active volcanoes and sprinkled with lakes and streams. According to Zhou, the unhatched bird likely lived in a tree near the water, its nest, he suspects, fell directly into a lake and was quickly buried. The specimen's intact preservation excludes the possibility that it was transported for a distance before being buried.

Summary of story from *National Geographic News*, October 21, 2004.

Britain's Biggest Dinosaur Found

Fossil hunters on the Isle of Wight have unearthed bones from the biggest dinosaur so far discovered in the UK. One fossil bone - a single neck bone from the 125-130-million-year-old sauropod dinosaur - measures an astonishing three-quarters of a metre in length, based on this, a team of UK and US researchers believes the huge animal was probably over 20 metres long and could have weighed as much as 40-50 tonnes. Physical features of the fossil suggest the British creature had similarities to two other known sauropods: *Brachiosaurus* and *Sauroposeidon*.

Fossil hunters have also discovered a second neck bone that probably comes from the same animal, but this is less well preserved and had been lying on the beach for some time, say researchers. Scientists say the sauropods skeleton had been eroding out of nearby cliffs and there may be more remains still to be found. The fossils originate in the best-known dinosaur-bearing rock unit in the Isle of Wight - the so-called Wessex Formation; this allowed the researchers to easily date the plant-eater to Lower Cretaceous times. It lived alongside other dinosaurs such as the bulky, beaked *Iguanodon* and the fleet-footed, two-legged *Hypsilophodon*.

The bone is certainly amongst the biggest ever found in Europe but as yet unpublished sauropod fossils from Portugal and Spain were even larger. In February 2004, researchers announced the discovery of fossilised bones from what would have been a 35 metre long sauropod weighing 50 tonnes near Riodeva in eastern Spain. The world's biggest and heaviest dinosaur is commonly said to be *Argentinasaurus*, a 37 metre long, 80-100 tonne sauropod known from South America. However, a 2.4 metre long fossil vertebra from a creature called *Amphicoelias fragillimus* was recovered from the Morrison Formation of

North America in 1877. Based on the description of the bone made by its discoverer Edward Drinker Cope, the animal it belonged to would have been some 52 metres in length; however, the huge specimen has since disappeared, which makes this impossible to verify.

Summary of story from *BBC News Online*, November 22, 2004.

Brazil Finds New Europe-Related Dinosaur Species

Scientists have found well-preserved fossils of a new dinosaur species that lived 225 million years ago in southern Brazil but had its closest relatives in what is now Europe, and is one of the most complete dinosaur finds from Brazil. This sheds light about life on Earth when there was one super continent and on dinosaur migration across this continent.

The paleontologists who described the new dinosaur, Alexander Kellner and Luciano Leal from the National Museum of Rio de Janeiro Federal University, said the Triassic period dinosaur was also "among the oldest finds in the world." The new dinosaur, *Unaysaurus tolentinoi*, represents a new class and new species as well as the first representative of the prosauropod group ever found in Brazil.

Unaysaurus tolentinoi was relatively small, measuring 2.5 metres, walked on its hind feet, as did most early dinosaurs, and was herbivorous. It was thought *Unaysaurus* would be related to dinosaurs from the same group already found in Argentina, but study revealed it was more like European forms. This shows that some dinosaurian migration during Triassic times is more complicated than initially thought, as what would become modern day Brazil is thought to have been joined to southwest Africa during the Triassic, a long way from the area where the European forms roamed.

The name *Unaysaurus* comes from the indigenous Indian word "unay" (u-na-hee) in Tupy language, meaning Black Water. Agua Negra (Black Water) is the Portuguese name for the region where the fossils were found. The species name *tolentinoi* honors local resident Tolentino Marafiga who first discovered the fossils cropping out on the side of a road that was being repaired in 1998. Agua Negra is in Brazil's southernmost state of Rio Grande do Sul near the Argentine border.

Summary of stories from various online news sites, December 2, 2004.